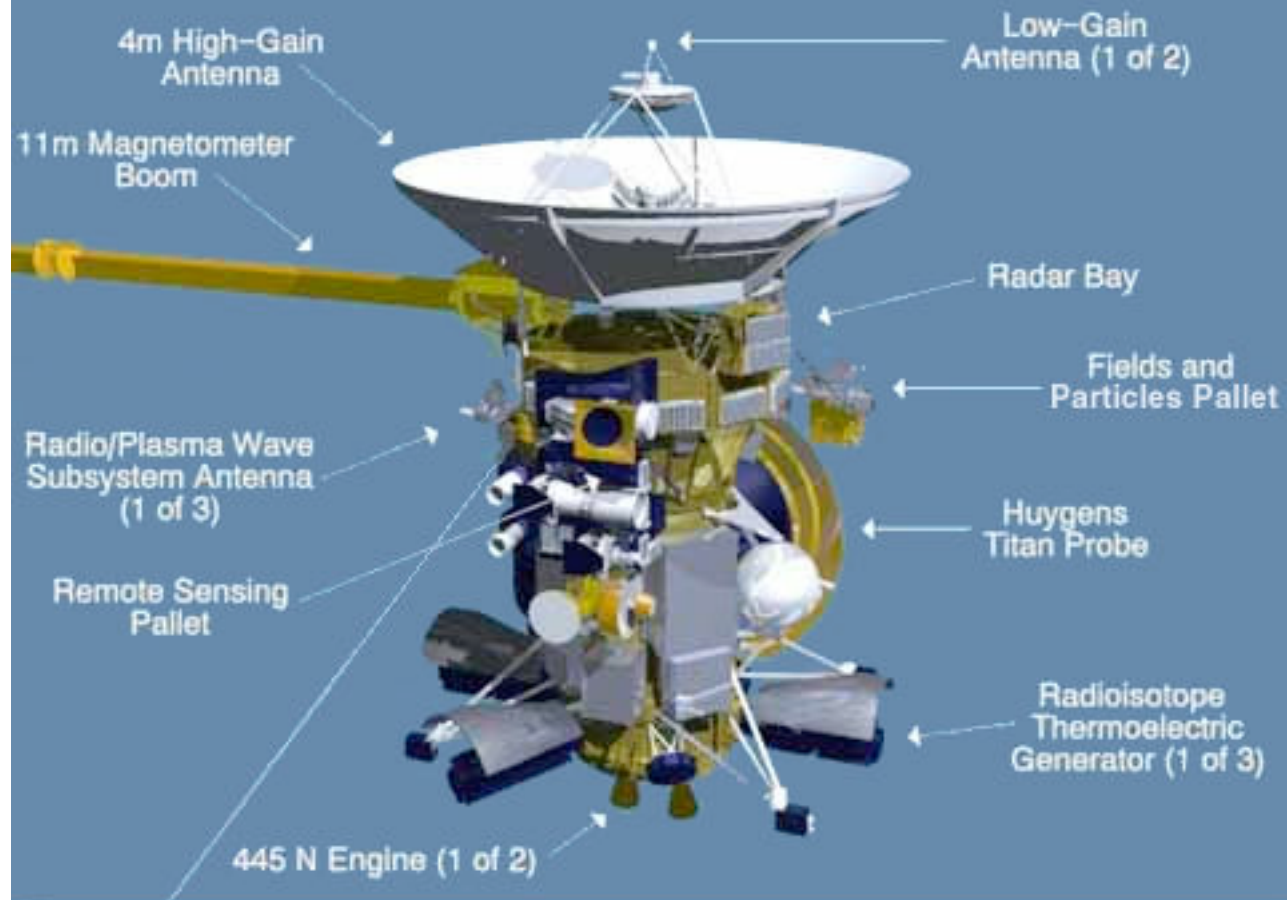


Cassini UV Imaging Spectrograph Observations of Saturn Rings

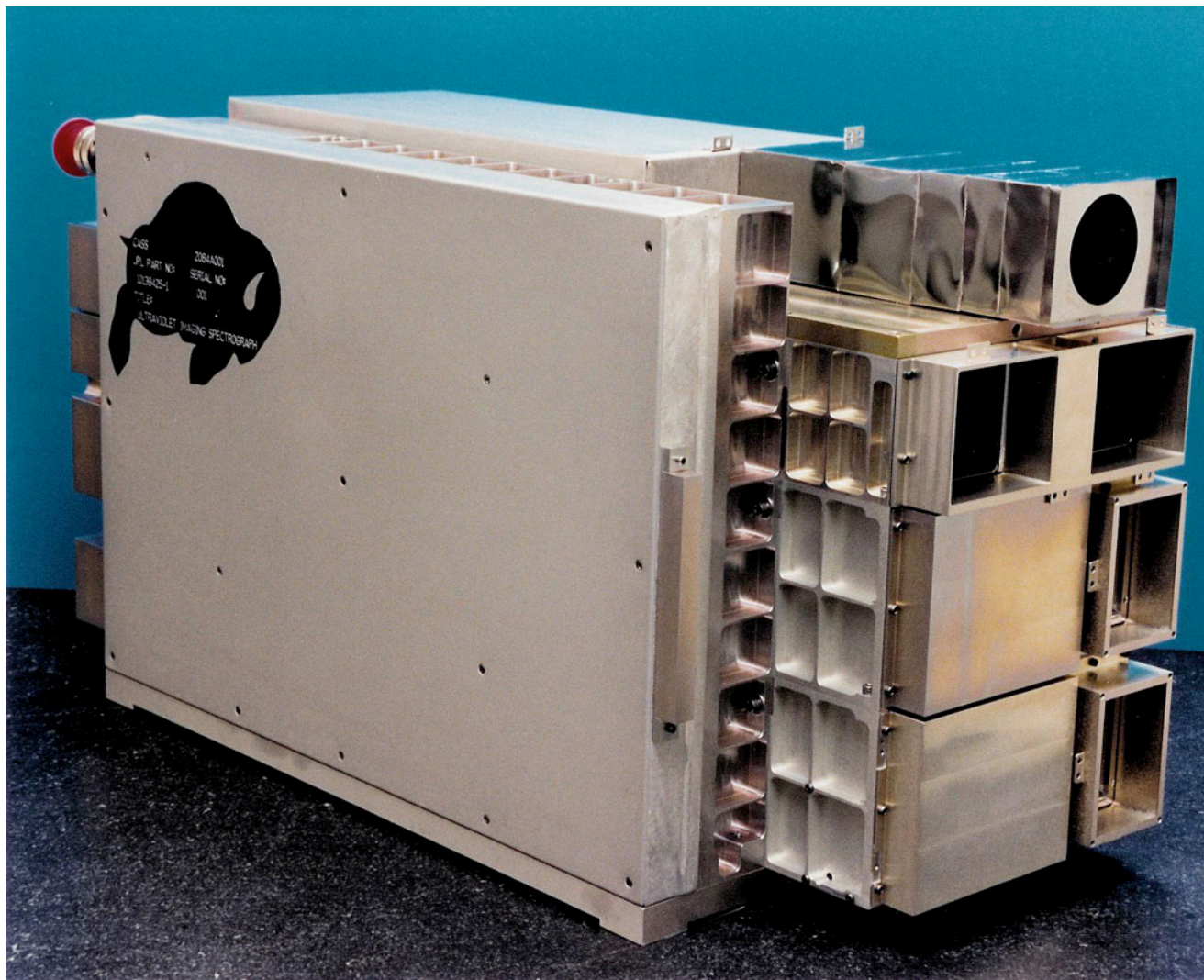
Larry W. Esposito
LASP, U. Colorado
and the UVIS Team
31 August 2004

CASSINI SPACECRAFT



Cassini UV Imaging Spectrograph

- Spectra and images from 550 -1900Å
- Hydrogen-Deuterium cell measures D/H
- High speed photometer has 20m resolution
- Chemistry of Saturn, Titan clouds
- Exospheres of moons
- Saturn's magnetosphere neutrals; thermosphere airglow and aurora
- Ring origin and evolution





UVIS OBSERVATIONS

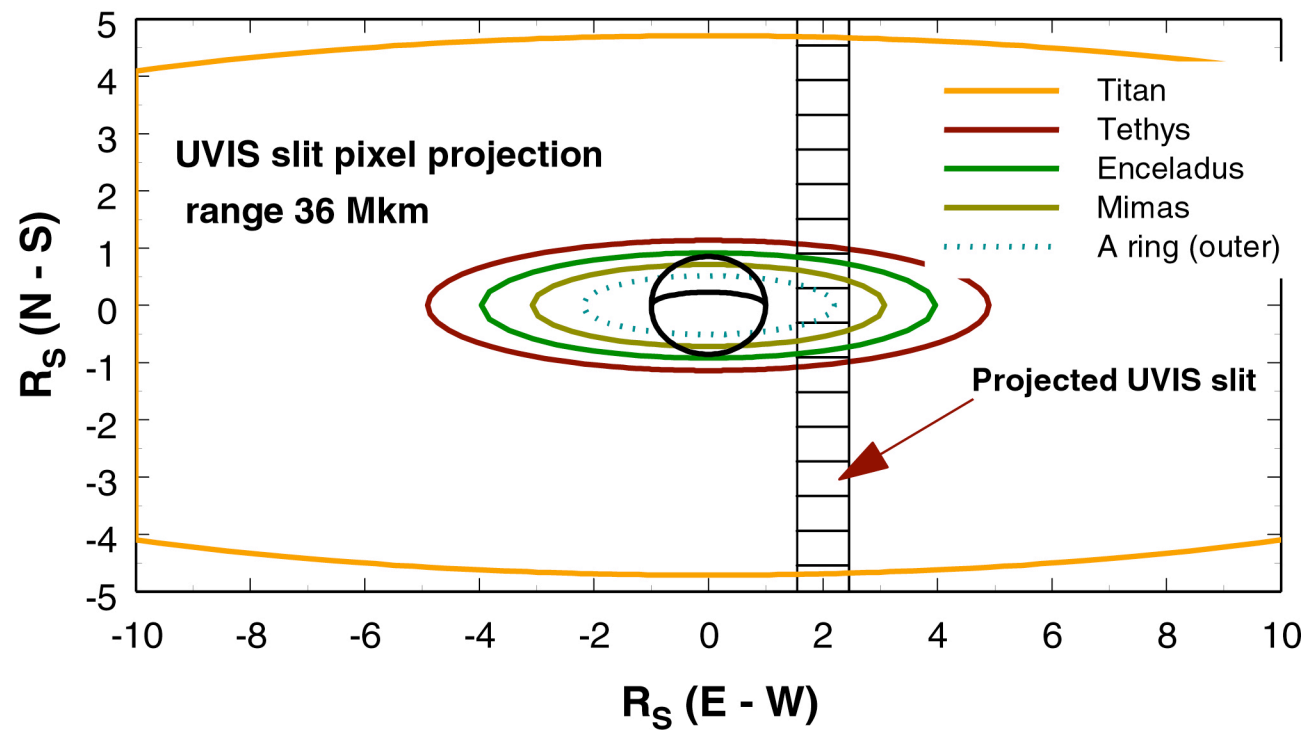
- SATURN SYSTEM SYSCANS
- SATELLITES DISTANT OCCULTATIONS
 LONGITUDE COVERAGE
- ATMOSPHERE OCCULTATIONS
 STARE
 LIMB SKIM
 AURORAL/AIRGLOW MAPS
 SPECTRAL IMAGES
- RINGS OCCULTATIONS
 SPECTROSCOPY
- MAGNETOSPHERE SURVEY & AURORA

SYSTEM SCANS

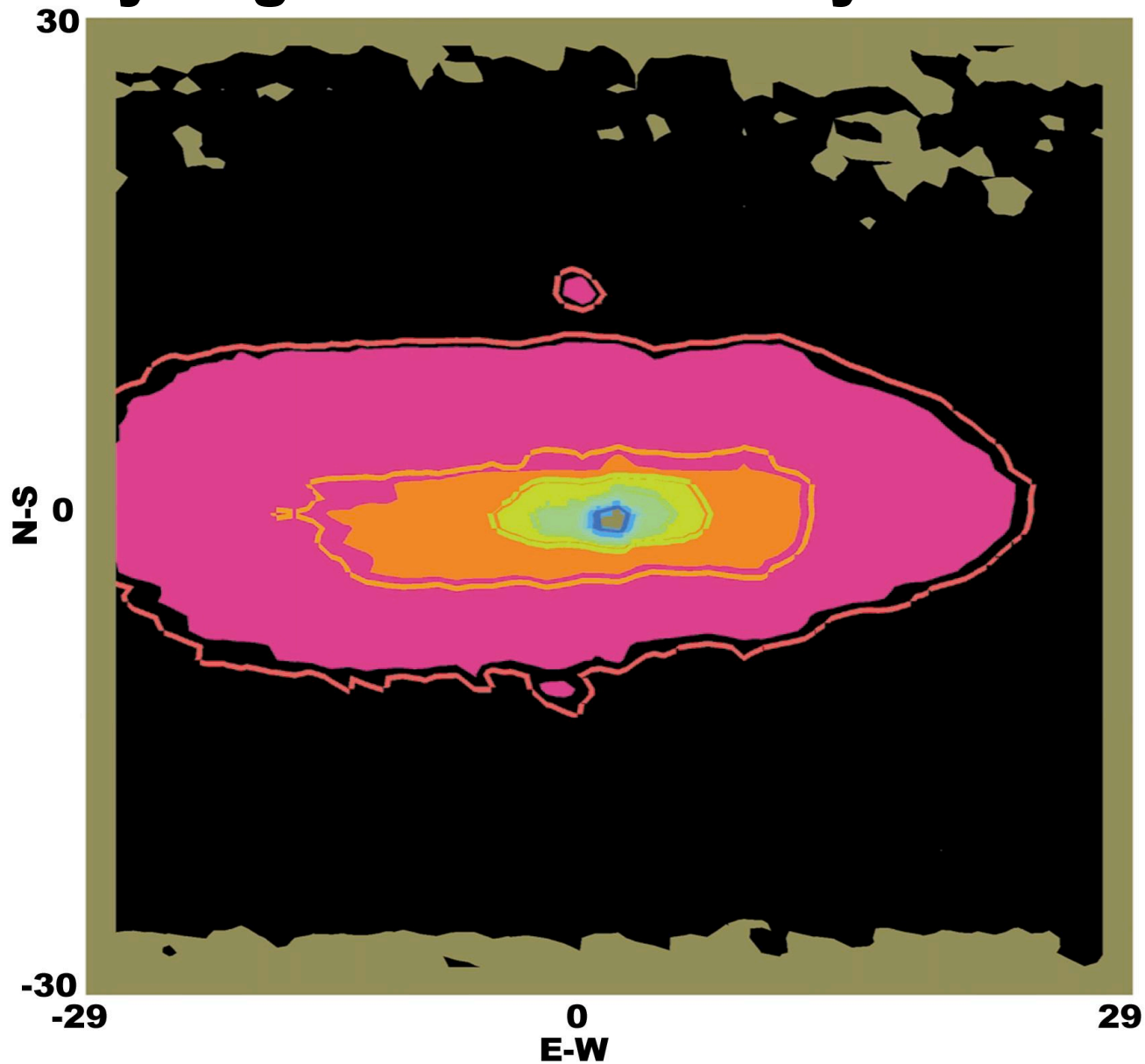
- Raster scan across Saturn system
- Shows hydrogen Lyman alpha, neutral oxygen atoms
- Hydrogen extends $45 R_s$ from Saturn
- Oxygen fluctuations show large source and loss:
water ice grains from moonlet collisions in E ring?
Could use all micron sized particles in 4 months!
- No gas torus seen from Titan or other satellites

Saturn system

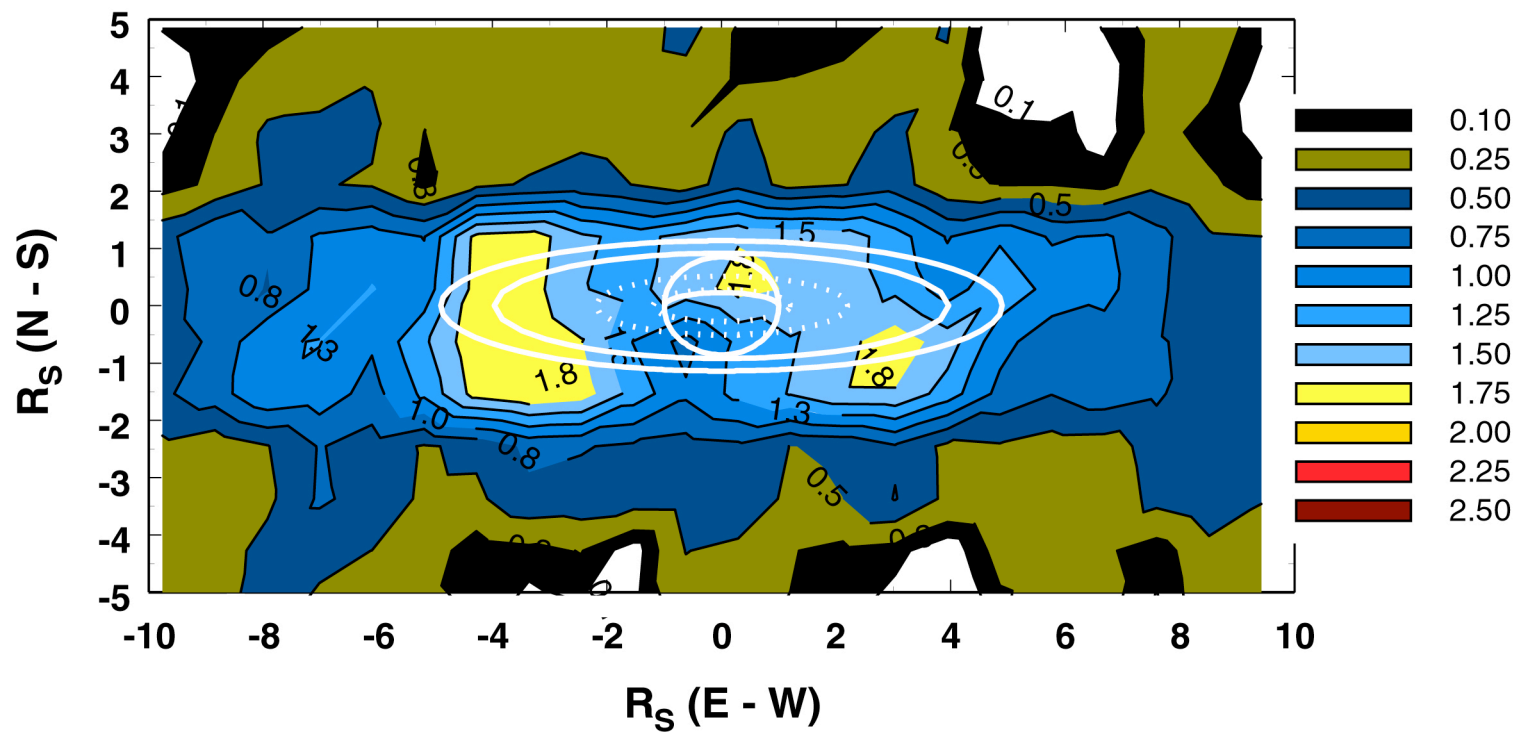
Cassini UVIS Observatory Period geometry



Cassini UVIS image of atomic hydrogen in the Saturn system



Cassini UVIS image
The Saturn magnetosphere in atomic oxygen emission
2004 DOY 37 -- 50



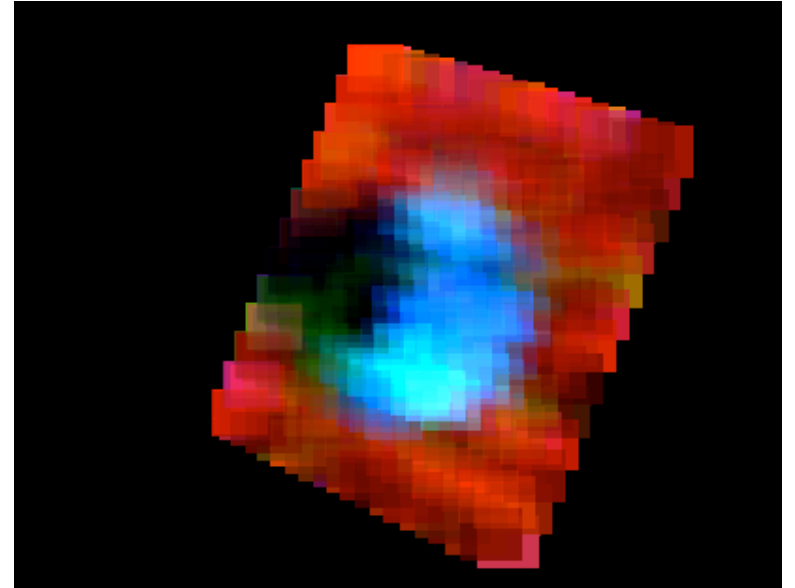
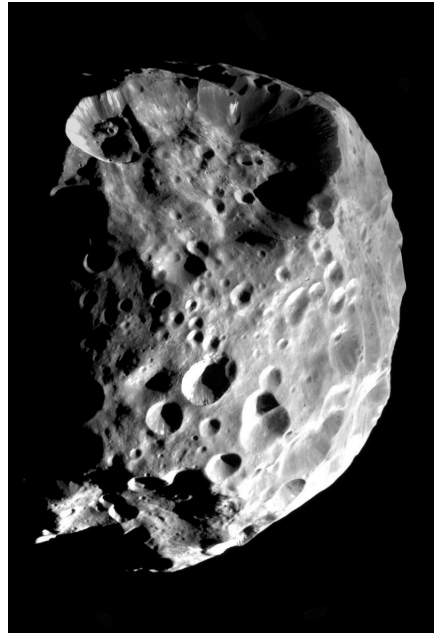
OXYGEN RESULTS

- **Oxygen is made from water ice broken apart into atoms**
- **This ice comes from the rings: maximum at E ring location**
- **One quarter of total oxygen in Saturn system was gained and then lost between Christmas and July**
- **This is as much as the estimated amount in micron sized particles in the E ring**
- **The oxygen may be the result of a collision in the ring and subsequent plasma bombardment**

PHOEBE RESULTS

- UV reflectance spectrum shows water ice
- Very low albedo: Phoebe blocks inter-planetary hydrogen emission
- Heterogeneous UV albedo: composition variations?
- No comet-like activity

CIRS_000PH_FP3EWMAP001

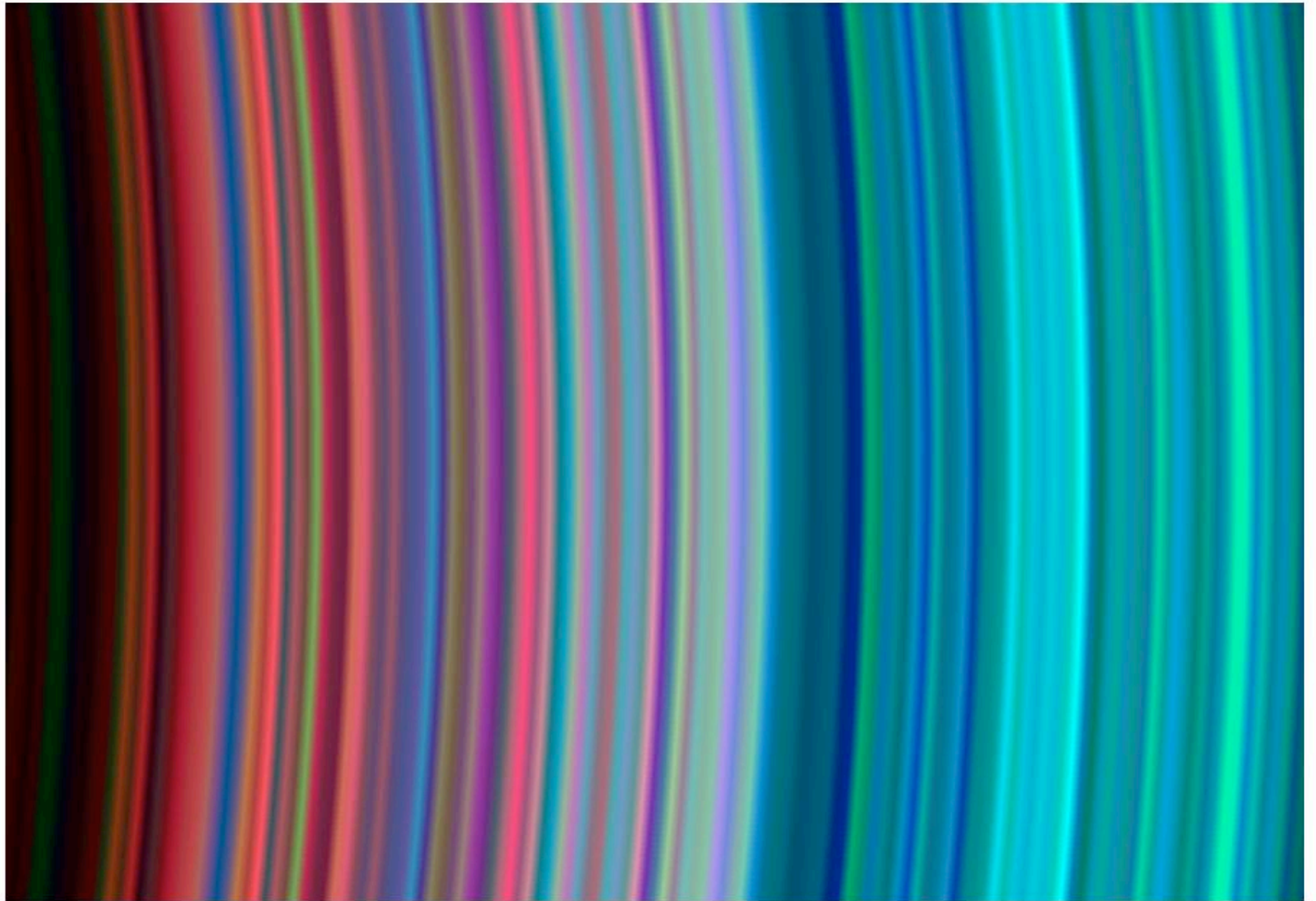


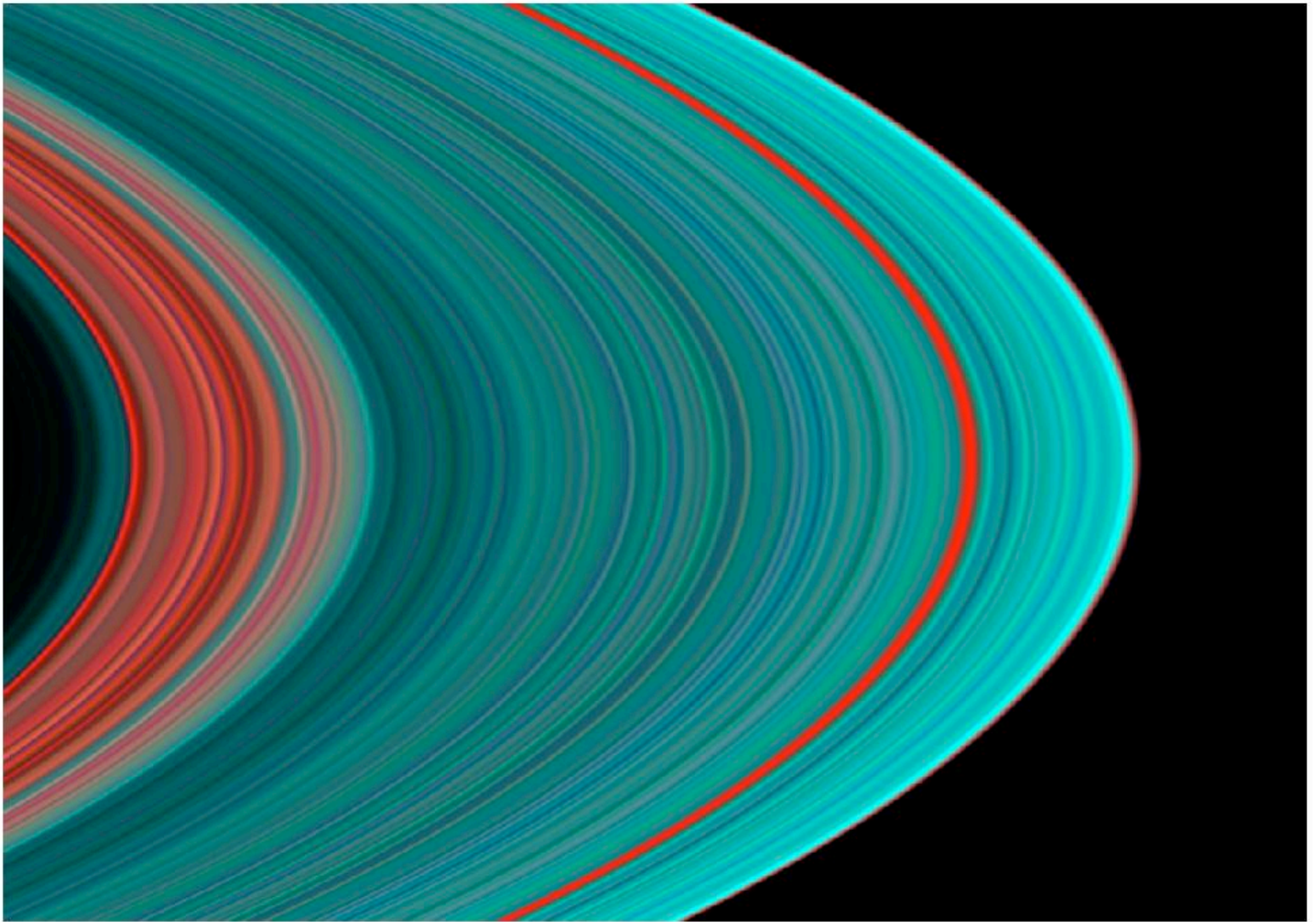
Time: C/A-01:22
Range: 31,300 km
Phase angle: 83°
Lat/Long: 21°S , 349°W

Blue/green=reflected solar
Red=background Ly- α (IPH)

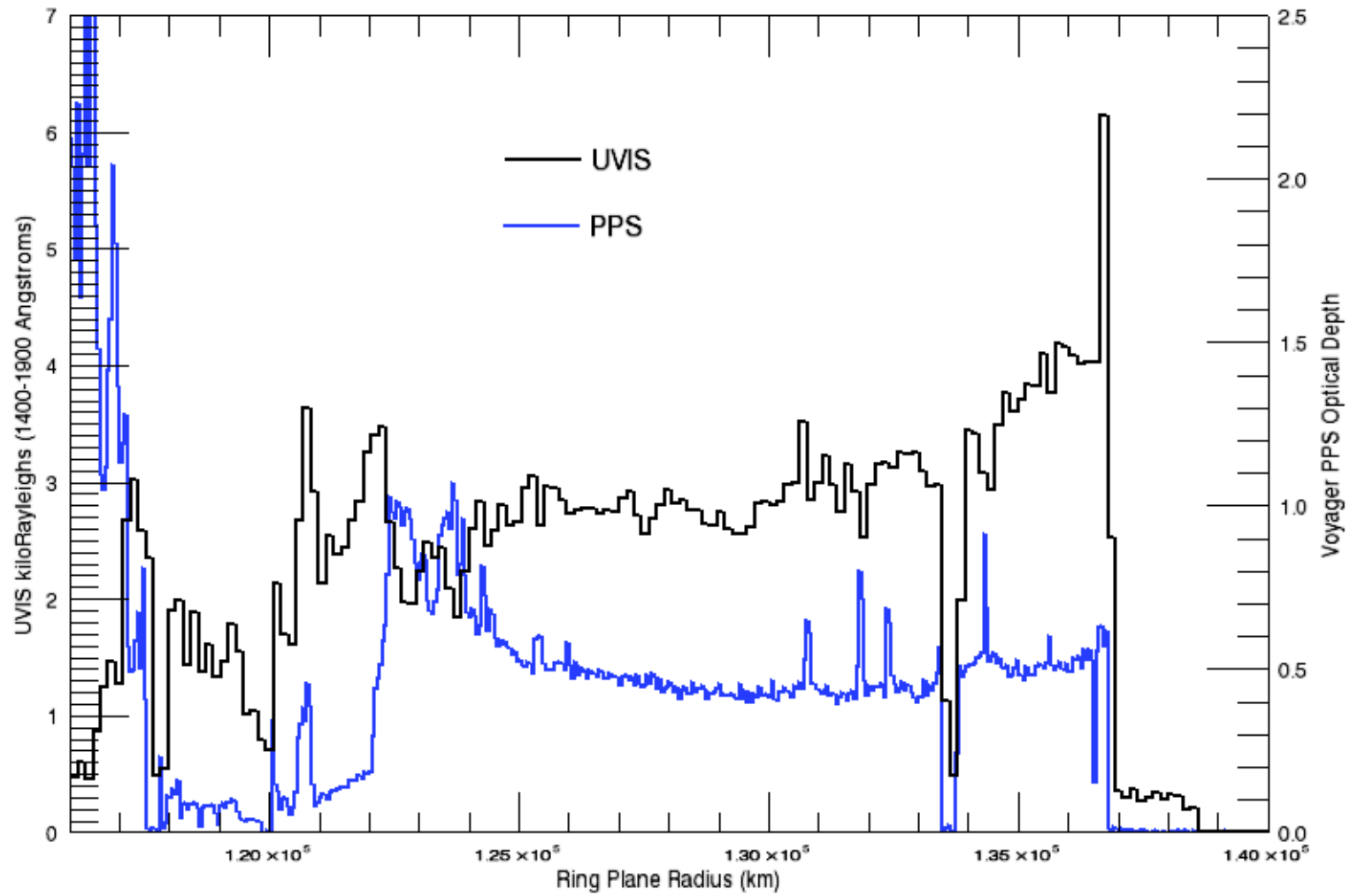
RINGS RESULTS

- UV spectra show water abundance increasing outward
- Rings A and B more icy than ring C and Cassini Division
- More structure than seen in Voyager images may show short-range transport processes





Cassini Division and A Ring Brightness Profile



HISTORY OF SATURN'S RINGS

- Not likely that ring differences are original
- Broad spectral variations show pollution of rings by meteorite bombardment
- Structure may indicate current processes, like recycling in rings
- Random events (like destruction of a small moon in the rings) makes them look young again

SUMMARY

- UVIS observed Saturn system, Titan, Phoebe, ring composition, aurora
- Hydrogen and oxygen are widely distributed, but nitrogen is not seen
- Spectra show varying water ice abundance
- Implications for ring history: random events, darkening by meteoritic dust and transport